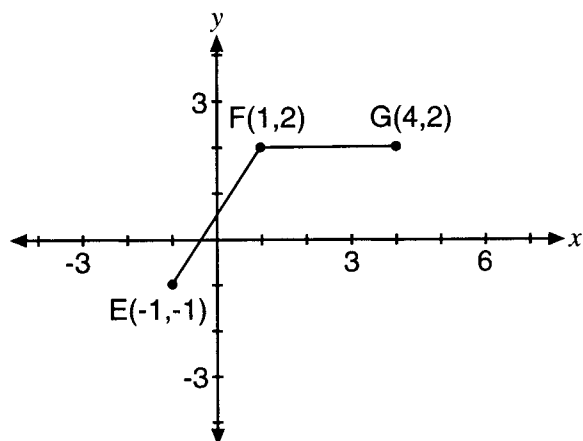# meap

Michigan Educational Assessment Program

High School Test in Mathematics

Released Items

Spring 2001

3   What would the coordinates of point H be in order for points E, F, G, and H to form a parallelogram?

A (2,−1)	**B** (3,−1)
C (6,−1)	**D** (−1,2)

4   Jupiter is approximately 780 million kilometers away from the sun. If light travels at a rate of about 3.0×10^5 km/sec, about how long does it take the light from the sun to reach Jupiter?

A 2.34×10^{14} seconds

B 2.34×10^{8} seconds

C 2.60×10^{3} seconds

D 2.60×10^{-1} seconds

6   Marcia compared the cost of renting a word processor from two different companies. Both companies charged a deposit plus a daily fee. Marcia made a graph to compare the rental fees.
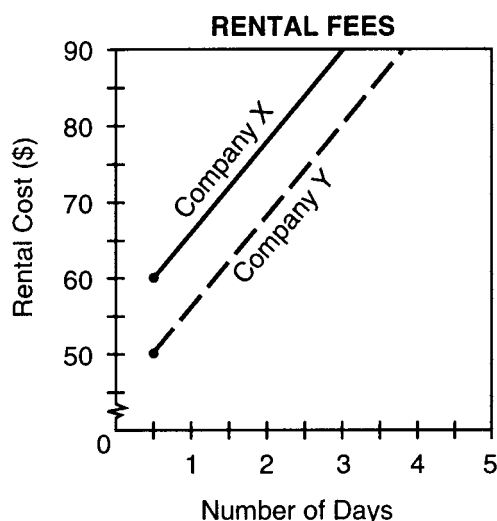
Based on the information in the graph, which statement is **TRUE**?

A   Company X charges a higher daily fee.

B   Company Y charges a higher deposit.

C   Both companies charge the same daily fee.

**D**   Both companies charge the same deposit.

8
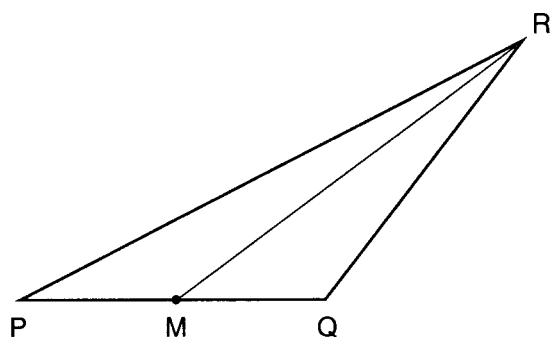
If M is the midpoint of $\overline{PQ}$, which statement is true about the relationship between triangle PMR and triangle QMR ?

A　Their areas are equal.

B　They are similar.

C　They are congruent.

D　Their perimeters are equal.

17　If you double the lengths of the sides of a square, the area of the square _____.

A　remains the same

B　becomes twice as large

C　becomes four times as large

D　becomes eight times as large

19　Which expression represents the area of the living room below?
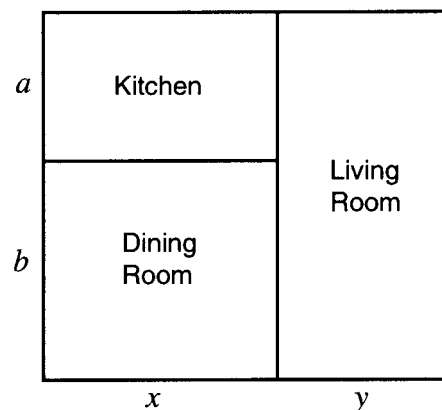
A　$(y-x)(a+b)$　B　$y(a+b)$

C　$(x+y)(a+b)$　D　$y(b-a)$

20　One number is selected at random from the set of numbers below.

$$.25 \quad 1\frac{1}{2} \quad 3.2 \quad \frac{7}{8} \quad \frac{9}{5}$$

What is the probability that the reciprocal of the number selected will be greater than 1 ?

A　$\dfrac{2}{5}$　　　　　　B　$\dfrac{3}{5}$

C　$\dfrac{3}{1}$　　　　　　D　$\dfrac{2}{1}$

23　Four firefighter teams raced in a field day event. Their times (in minutes) were 2.207, 1.720, 2.072, and 1.207. If the sponsors of **EACH** of the losing teams donated one dollar to charity for every one-thousandth of a minute difference between the winning time and their team's time, how much did the sponsors of the **losing teams** donate altogether?

A　$513　　　　　　B　$865

C　$1000　　　　　D　$2378

33)   **3 Points**

In order to continue a new expressway, the highway department needs to build a tunnel through a mountain. To accomplish this, they need to know the distance from point P to point Q. The workers placed markers at points P, Q, R, S, and T, and measured the distances marked in the diagram.
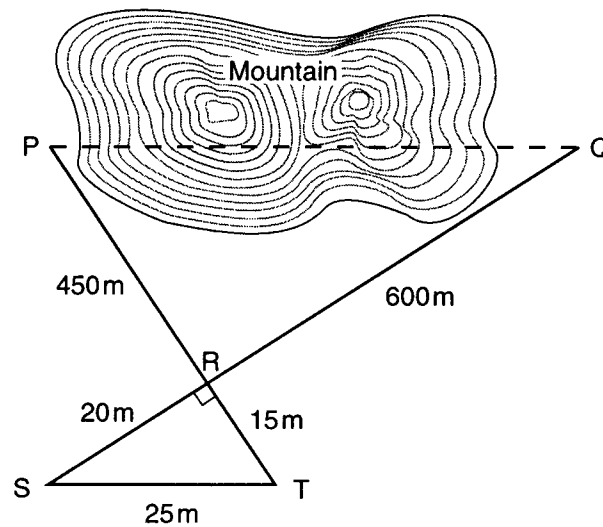
Note: Drawing is not to scale

What is the distance from point P to point Q? Provide the work that shows how you arrived at your answer.

33a)   Exemplar

In order to continue a new expressway, the highway department needs to build a tunnel through a mountain. To accomplish this, they need to know the distance from point P to point Q. The workers placed markers at points P, Q, R, S, and T, and measured the distances marked in the diagram.
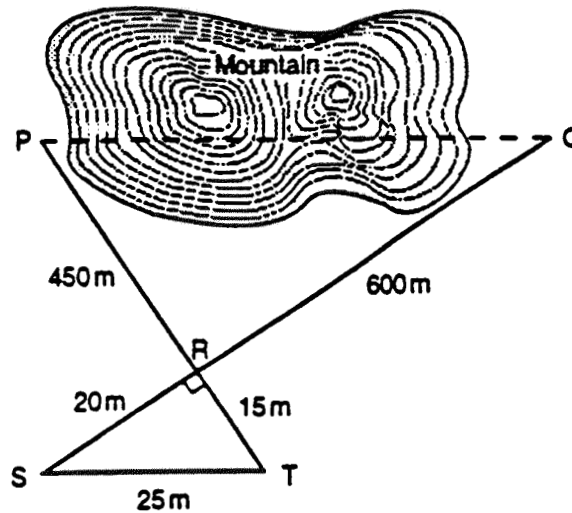

Note: Drawing is not to scale

What is the distance from point P to point Q ? Provide the work that shows how you arrived at your answer.

$$c^2 = a^2 + b^2$$

$$c^2 = (450)^2 + (600)^2 = 202,500 + 360,000$$

$$c^2 = 562,500$$

$$C = 750 \text{ m} \quad \text{or} \quad 750$$

OR

$$\frac{600}{20} = \frac{450}{15} = 30, \quad \triangle SRT \cong \triangle PRQ \text{(Vertical angles} \cong\text{)}$$

Therefore triangles are similar

$$\frac{600}{20} = \frac{x}{25} \qquad\qquad \frac{450}{15} = \frac{x}{25}$$

$$20x = 600(25) \quad OR \quad 15x = 450(25)$$

$$x = 750 \qquad\qquad x = 750$$

OR

Recognizes 3-4-5 Right △'s and correctly applies ratios of sides

33b) Scoring Rubric

TOTAL POINT VALUE: 3

3   Correct distance showing work

2   Correct distance showing partial work
                OR
         Incorrect distance showing work with computational error indicating a reasonable
         understanding of the process

1   Correct distance not showing work or incorrect approach
                OR
         Partial setup without arriving at an answer, or arriving at an incorrect answer

0   Other

33c)   **Student Response 1**

In order to continue a new expressway, the highway department needs to build a tunnel through a mountain. To accomplish this, they need to know the distance from point P to point Q. The workers placed markers at points P, Q, R, S, and T, and measured the distances marked in the diagram.
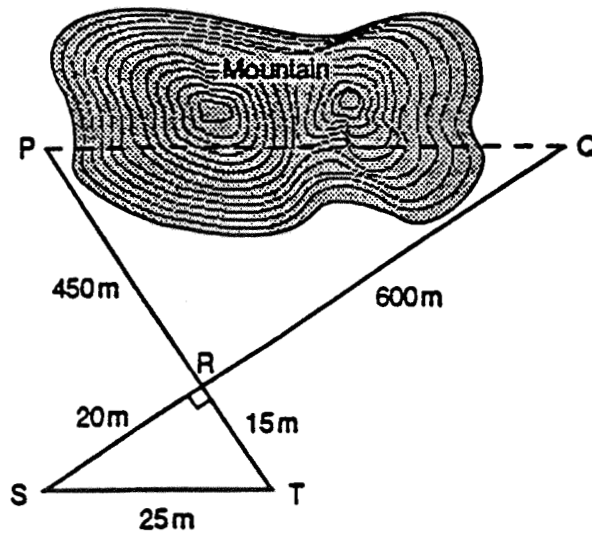
Note: Drawing is not to scale

What is the distance from point P to point Q? Provide the work that shows how you arrived at your answer.

Score Point: 3

The setup is complete and the correct distance is given. The respondent has correctly recognized that the triangles are similar and has used the ratio 30:1 to solve for the hypotenuse P,Q.

33d)   Student Response 2

In order to continue a new expressway, the highway department needs to build a tunnel through a mountain. To accomplish this, they need to know the distance from point P to point Q. The workers placed markers at points P, Q, R, S, and T, and measured the distances marked in the diagram.
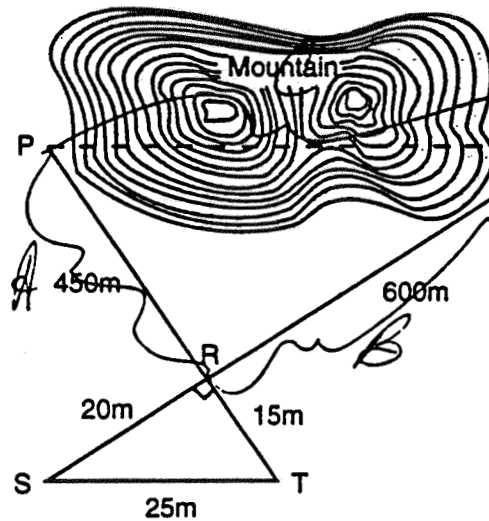
$$A^2 + B^2 = C^2$$
$$450^2 + 600^2 = C^2$$
$$C = \overline{PQ}$$
$$202,500 + 360,000 = C^2$$
$$562,500 = C^2$$
$$\sqrt{562,500} = C$$

Note: Drawing is not to scale

What is the distance from point P to point Q? Provide the work that shows how you arrived at your answer.

Answer $\longrightarrow$ $\overline{PQ} = 750m$

See work above

Score Point: 3

This presentation shows the correct application of the Pythagorean Theorem to solve for the hypotenuse P,Q. All work is shown and the correct distance is given.

33e) Student Response 3

In order to continue a new expressway, the highway department needs to build a tunnel through a mountain. To accomplish this, they need to know the distance from point P to point Q. The workers placed markers at points P, Q, R, S, and T, and measured the distances marked in the diagram.
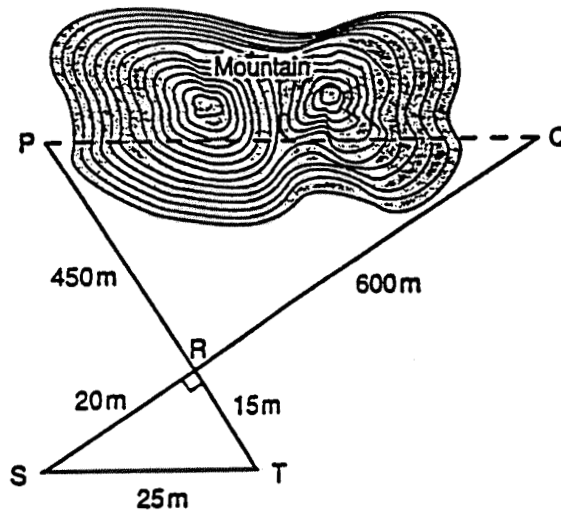
Note: Drawing is not to scale

What is the distance from point P to point Q ? Provide the work that shows how you arrived at your answer.

$$S-R=20m$$
$$S-T=25m$$
$$R-T=15m$$
$$P-Q=X$$
$$RQ=600m$$
$$PR=450m$$
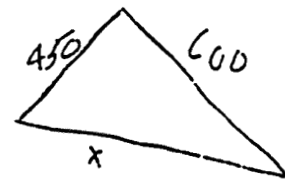
$$20 \times 30 = X \qquad PQ=600$$

The Distane from point P to point Q is 600m

Score Point: 2

The setup of this presentation is complete, but a procedural error (20 x 30 = X) results in the wrong distance for P,Q.

33f)   Student Response 4
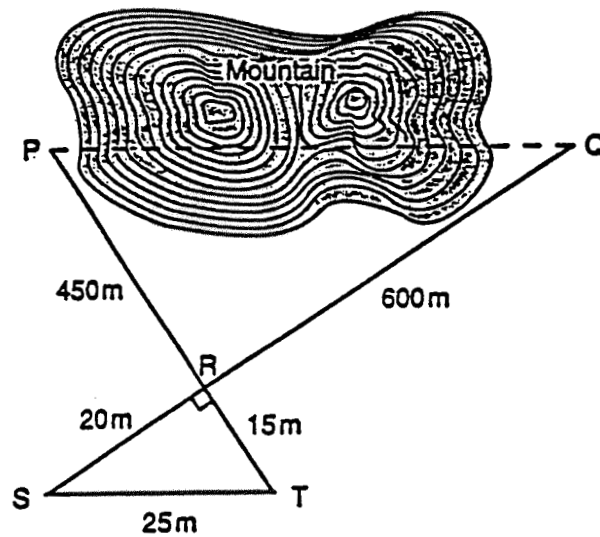
What is the distance from point P to point Q? Provide the work that shows how you arrived at your answer.

$$600^2 + 450^2 = 603.74001^2$$

$$\overline{PQ} = 603.74001$$

Score Point: 1

The usage of the Pythagorean Theorem indicates partial understanding of the correct process in this response. No work is shown, making it difficult to discern where the incorrect distance, PQ = 603.74001, came from.

33g) Student Response 5
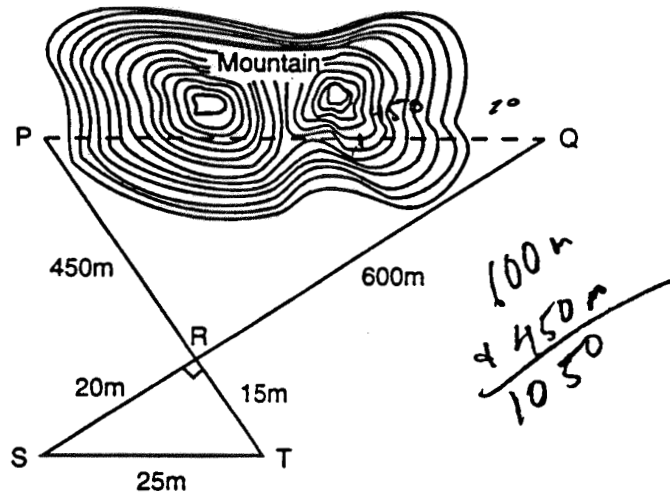
Note: Drawing is not to scale

What is the distance from point P to point Q ? Provide the work that shows how you arrived at your answer.

$$QR = 600 \, M$$
$$PR = 450 \, M$$
$$A^2 + B^2 = C^2$$
$$A^2 = 600m + B^2 = 450m = \boxed{PQ \\ 1050m}$$

Score Point: 1

This response indicates understanding that the Pythagorean Theorem may be used to find the correct distance for line P,Q, but the computation is incorrect. Also, the work shown does not demonstrate the ability to correctly square the numbers 450 and 600.

35)   3 Points

Amy has test scores of 75, 89, 94, and 86 from four 100-point tests. The final exam counts as two tests and therefore is worth 200 points. Can Amy bring her average up to 90% when she takes the final exam? If so, what score must she get? If not, explain why not. Provide a complete explanation to show how you arrived at your answer.

35a)   Exemplar

1. $90\% \rightarrow 0.90$

$$\frac{75 + 89 + 94 + 86 + x}{4(100) + 200} = 0.90 \rightarrow \frac{90\%}{100\%}$$

$$344 + x = 0.90(600)$$

$$x = 540 - 344$$

$$x = 196$$

Yes, 196 points, or more, will bring her average up to 90%, because :

$$\frac{344 + 196}{600} = 0.90 \text{ or } 90\%$$

_____

OR

2. $$\frac{x + 75 + 89 + 94 + 86}{6} = 90$$

$$x + 344 = 6(90) = 540$$

$$x = 196$$

_____

OR

3.   Total score will equate to $4 \times 100 + 200 = 600$
90% average would require $90\% \times 600 = 540$ points
$75 + 89 + 94 + 86 = 344$ current points on 4 tests
$540 - 344 = 196$ points required on final exam

_____

OR

4. $$75 \quad 89 \quad 94 \quad 86 \quad 100 \quad 100 \quad \therefore 200 - 4 = 196$$

(with annotations: -15, -1, $+4$, -4, $+10$, $+10$, 90 circled, $= +4(\text{extra points})$)

35b)   Scoring Rubric

TOTAL POINT VALUE: 3

3   Correct score showing work or explaining procedure
        or answer ("Yes" is not required)

2   Incorrect score showing work with a minor computation
        error, indicating reasonable understanding of the
        correct process

                        OR

        Correct answer showing partial work

1   Correct score not showing work or explaining procedure

                        OR

        Partial setup of correct procedure without arriving
        at an answer, or arriving at an incorrect answer

                        OR

        Incorrect answer ("NO") showing incorrect procedure
        or work to explain "NO"

0   Other

Note: "98" OR "98%" is an acceptable response
         (equivalent to 196/200)

35c) Student Response 1

Amy has test scores of 75, 89, 94, and 86 from four 100-point tests. The final exam counts as two tests and therefore is worth 200 points. Can Amy bring her average up to 90% when she takes the final exam? If so, what score must she get? If not, explain why not. Provide a complete explanation to show how you arrived at your answer.

$$\frac{75+89+94+86+2x}{6} = 90$$

$$\frac{344+2x}{6} = 90 \cdot 6$$

$$344+2x = 540$$
$$\underline{-344 \qquad -344}$$
$$\frac{2x}{2} = \frac{196}{2} \qquad x = 98$$

Yes, Amy can get a 90% but only if she scores a 98% or higher on her final exam.

Score Point: 3

This respondent's correct answer and algebraic setup indicate complete understanding of the process.

35d)   Student Response 2

Amy has test scores of 75, 89, 94, and 86 from four 100-point tests. The final exam counts as two tests and therefore is worth 200 points. Can Amy bring her average up to 90% when she takes the final exam? If so, what score must she get? If not, explain why not. Provide a complete explanation to show how you arrived at your answer.

Score Point: 2

This response includes the correct answer showing partial work.

35e)   Student Response 3

Amy has test scores of 75, 89, 94, and 86 from four 100-point tests. The final exam counts as two tests and therefore is worth 200 points. Can Amy bring her average up to 90% when she takes the final exam? If so, what score must she get? If not, explain why not. Provide a complete explanation to show how you arrived at your answer.

$$\frac{75+89+94+86}{400pts} = 86\%$$

$$\frac{344+X}{600} = 90\%$$

if she got a 100 on the test she could do it

Score Point: 2

The correct setup is demonstrated, but the final answer of 100 is incorrect.

35f)   Student Response 4

Amy has test scores of 75, 89, 94, and 86 from four 100-point tests. The final exam counts as two tests and therefore is worth 200 points. Can Amy bring her average up to 90% when she takes the final exam? If so, what score must she get? If not, explain why not. Provide a complete explanation to show how you arrived at your answer.

yes, she must get a 98%

Score Point: 1

The correct score is given (98%) without showing work or giving an explanation.

35g)   Student Response 5

Amy has test scores of 75, 89, 94, and 86 from four 100-point tests. The final exam counts as two tests and therefore is worth 200 points. Can Amy bring her average up to 90% when she takes the final exam? If so, what score must she get? If not, explain why not. Provide a complete explanation to show how you arrived at your answer.

$$75, 89, 94, 86 = 86\%$$

$$\frac{}{100} \quad \frac{}{100} \quad \frac{}{100} \quad \frac{}{100} \quad \frac{200}{200} \quad = \quad \frac{544}{600} = 906\%$$

Yes. She must get

$$\frac{344}{600}$$

$\underline{If}$ her teacher rounds up, she must get at least a $\frac{193}{200}$ on her last test

She is currently getting an 86% if she gets a 193/200 score on her last test, that percent of that test is 96.5%

$$\frac{86\% + 96.5\%}{2} = \underline{\underline{91\%}}$$

Score Point: 1

The answer given is incorrect, but the setup used indicates partial understanding of the correct procedure.

36)   2 Points

Sixteen students in a class were asked how much television they watched last week. The dot frequency diagram shows their responses.

Number of Hours Watching Television
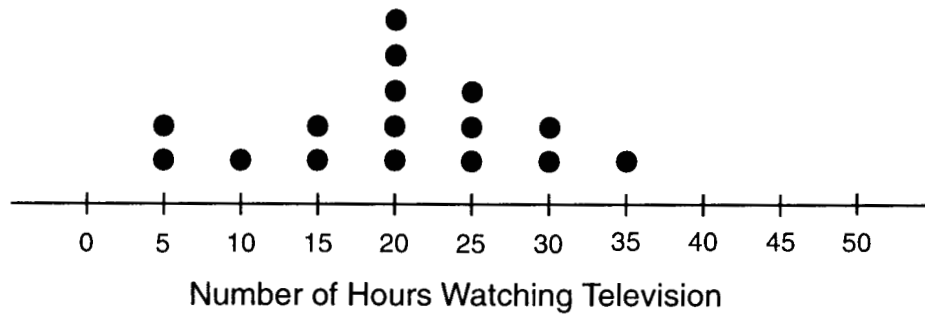
Describe the interval from minimum to maximum viewing time in hours.

A   Describe the interval in words.

B   Describe the interval as an inequality using mathematical notation.

36a)   Exemplar

Sixteen students in a class were asked how much television they watched last week. The dot frequency diagram shows their responses.

Number of Hours Watching Television

Describe the interval from minimum to maximum viewing time in hours.

A   Describe the interval in words.

They watched a minimum of 5 to a maximum of 35 hours of television.

OR

from five to thirty-five

OR

at least five but no more than 35

OR

more than or equal to five hours and less than or equal to 35

OR

between 5 and 35 inclusive

Note: The following are correct for Part A only if the response to Part B is correct.
more than five and less than 35 hours
between 5 and 35 hours

B   Describe the interval as an inequality using mathematical notation.

x = number of hours watching television

1) $5 \leq x \leq 35$ OR $35 \geq x \geq 5$
2) $x \geq 5,\ x \leq 35$
3) $4 < x < 36$
4) $x > 4,\ x < 36$
5) $0 < x < 40$
6) $0 < x \leq 35$
7) $5 \leq x < 40$
8)
9) $[5, 35]$
10) $(0, 40)$

36b) Scoring Rubric

TOTAL POINT VALUE: 2

2 Correct description in words
    AND
    Correct description as an inequality

1 One of the above (may answer Part A in space for Part B or vice-versa)

0 Other

36c) Student Response 1

Sixteen students in a class were asked how much television they watched last week. The dot frequency diagram shows their responses.

Number of Hours Watching Television
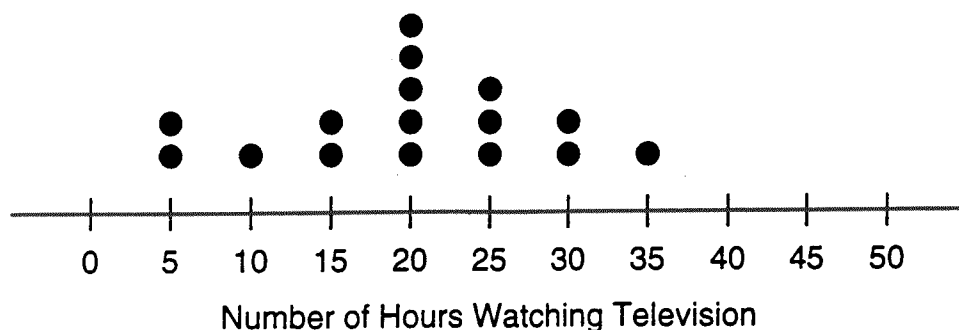
Describe the interval from minimum to maximum viewing time.

A Describe the interval in words.

In the survey, the students watched
between 5 and 35 hours of Television.
The majority of students watched 20 hours

B Describe the interval as an inequality using mathematical notation.

x = # of hours watching T.V.

$5 \leq x \leq 35$

Score Point: 2

Although the response to Part A uses the words "between hours," the correct description as an inequality is given in Part B.

36d)   Student Response 2

Sixteen students in a class were asked how much television they watched last week. The dot frequency diagram shows their responses.

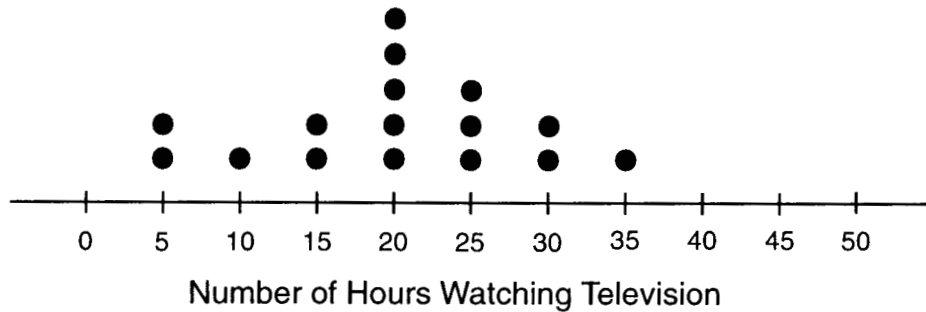Number of Hours Watching Television
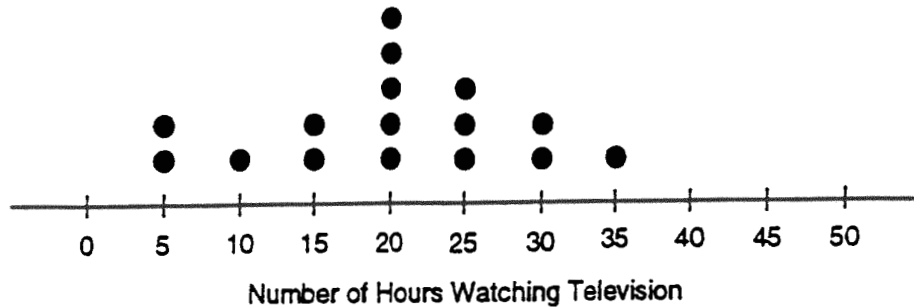
Describe the interval from minimum to maximum viewing time.

A   Describe the interval in words.

The maxieum amount of viewing time was 35 hours, and the minimum viewing time was 5 hours.

B   Describe the interval as an inequality using mathematical notation.

The viewing time "V" is greater than 5 hours, but less than 35 hours

$5 < V < 35$

Score Point: 1

Part A is correct, but the response to Part B is not a correct description as an inequality.

37)   4 Points

Manny is offered the choice of the following two pay scales at his new job.

    (1) He will receive $5 per hour regardless of the number of hours he works.

    (2) He will receive $4 per hour for each hour he works up to and including 30 hours per week, and $7 per hour for each hour he works over 30 hours per week.

A Create a table to show each pay scale. Begin the table at 20 hours of work for each pay scale and include entries for each additional five hours of work. Then indicate the pay scale, (1) or (2), from which Manny can make the most money.

B Will Manny make the most money from the answer you indicated in Part A all the time? If not, how long must he work before one pay scale is better than the other? Justify your answer.

37a)   **Exemplar**

Manny is offered the choice of the following two pay scales at his new job.

(1)   He will receive $5 per hour regardless of the number of hours he works.

(2)   He will receive $4 per hour for each hour he works up to and including 30 hours per week, and $7 per hour for each hour he works over 30 hours per week.

A   Create a table to show each pay scale. <u>Begin the table at 20 hours of work for each pay scale and include entries for each additional five hours of work.</u> Then indicate the pay scale, (1) or (2), from which Manny can make the most money.

Hours	Pay Scale (1)	Pay Scale (2)
20	$100	$80
25	125	100
30	150	120
35	175	155
40	200	190
45	225	225
50	250	260
55	275	295

Pay scale (1) is best

Pay Scale (1) & (2) equal

Pay scale (2) is best

Indicates (1) or (2)

B   Will Manny make the most money from the answer you indicated in Part A all the time? If not, how long must he work before one pay scale is better than the other? Justify your answer.

No. If he works more than 45 hours pay scale (2) is better, less than 45 hours pay scale (1) is better, and exactly 45 hours the scales are the same.
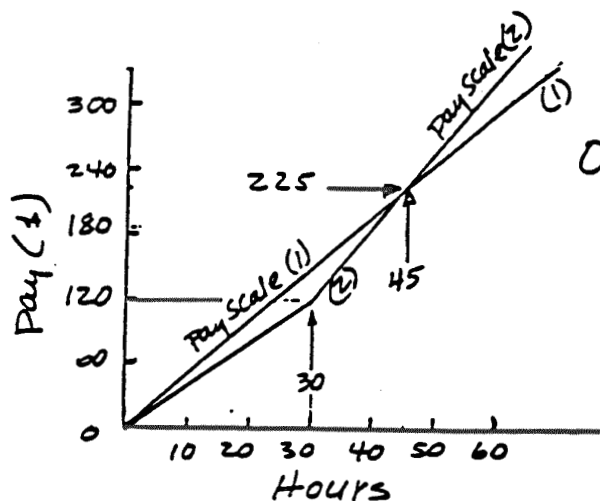
(1) $5 × 30 = $150
(2) $4 × 30 = $120
$150 − $120 = $30

OR

$30 ÷ ($7 − $5) = 15 hr
30 + 15 = 45 hr.

37b)   **Scoring Rubric**

PART A (2 points)

2   Correct and complete table with values on both sides of 30 hour week
> **AND**

Indicates correct pay scale according to work shown

1   Correct table (may be incomplete) with values on both sides of 30 hour week
> **OR**

Indicates correct pay scale according to work shown

0   Other

PART B (2 points)

2   Correct answer based on work in Part A ("greater than 45 hours" is correct answer if table in Part A goes beyond 45 hours)
> **AND**

Correct justification showing work

1   Correct answer ("more than 45 hours" or answer based on work in Part A)
> **OR**

Correct justification
> **OR**

Incorrect answer showing work with computational error

0   Other

NOTE: Part A must show a <u>table</u>, but it may be expressed in words.
Part B is consistent with Part A. If answers are based on a table only reaching 35 hours, response may still receive full credit.
Correct table in Part A may serve as justification for Part B.

If student does not indicate a pay scale for Part A but completely explains the difference between the two pay scales in Part B, response may still receive full credit.

37c)   Student Response 1

Manny is offered the choice of the following two pay scales at his new job.

(1)   He will receive $5 per hour regardless of the number of hours he works.

(2)   He will receive $4 per hour for each hour he works up to and including 30 hours per week, and $7 per hour for each hour he works over 30 hours per week.

A   Create a table to show each pay scale. Begin the table at 20 hours of work for each pay scale and include entries for each additional five hours of work. Then indicate the pay scale, (1) or (2), from which Manny can make the most money.

(1)

hrs	$
20	$100
25	$125
30	150
35	175
40	200
45	225
50	250
55	275

(2)

hrs	$
20	80
25	100
30	120
35	155
40	190
45	225
50	260
55	295

B   Will Manny make the most money from the answer you indicated in Part A all the time? If not, how long must he work before one pay scale is better than the other? Justify your answer.

No, he won't make the most all of the time on scale 2. He must work 50 hrs. See the scale for justification

Score Point: 4

A correct and complete table is shown in Part A and the student indicates (2) based on the work shown. In Part B, the correct answer based on Part A is given and the student refers to "the scale" in Part A for justification.

37d)   Student Response 2

Manny is offered the choice of the following two pay scales at his new job.

(1)   He will receive $5 per hour regardless of the number of hours he works.

(2)   He will receive $4 per hour for each hour he works up to and including 30 hours per week, and $7 per hour for each hour he works over 30 hours per week.

A   Create a table to show each pay scale. Begin the table at 20 hours of work for each pay scale and include entries for each additional five hours of work. Then indicate the pay scale, (1) or (2), from which Manny can make the most money.

From pay scale 1 he will recieve more pay.

Hrs worked	Pay recieved	
	Pay Scale 1	Pay Scale 2
20	100	80
25	125	100
30	150	120
35	175	155
40	200	190
45	225	225

B   Will Manny make the most money from the answer you indicated in Part A all the time? If not, how long must he work before one pay scale is better than the other? Justify your answer.

No, he will not always make the same amount of money. When both scales hit 40 hours, then they are the same. After that, Scale 1 does not pay better, scale 2 pays better because it is $7 an hour vs. $5 an hour. If Manny worked under 40 hours, Scale 1 would be better. If he works over 40 hours, Scale 2 would be better.

Score Point: 3

In Part A, correct complete table and the correct pay scale is indicated based on the work shown. In Part B, the correct answer is given based on the work shown in Part A but the justification is incorrect.

37e)   Student Response 3

Manny is offered the choice of the following two pay scales at his new job.

    (1)   He will receive $5 per hour regardless of the number of hours he works.

    (2)   He will receive $4 per hour for each hour he works up to and including 30 hours per week, and $7 per hour for each hour he works over 30 hours per week.

A   Create a table to show each pay scale. Begin the table at 20 hours of work for each pay scale and include entries for each additional five hours of work. Then indicate the pay scale, (1) or (2), from which Manny can make the most money.

```
(1)  20 | 100        (2)  20 | 80
     25 | 125             25 | 100
     30 | 150             30 | 120
     35 | 175             35 | 155
     40 | 200             40 | 225
```

B   Will Manny make the most money from the answer you indicated in Part A all the time? If not, how long must he work before one pay scale is better than the other? Justify your answer.

Manny will not make the most money all the time?

If Manny work 40 hours per week his best pay will be (2) 4 dollars per hour for 30 hours and 7 dollars per hour if he worked over 30 hours.

Score Point: 2

In Part A, the table is not clearly and correctly done and no pay scale is indicated, so no credit is given. In Part B, the student gives the correct answer based on work in Part A and the correct justification.

37f)   Student Response 4

Manny is offered the choice of the following two pay scales at his new job.

(1) He will receive $5 per hour regardless of the number of hours he works.

(2) He will receive $4 per hour for each hour he works up to and including
30 hours per week, and $7 per hour for each hour he works over
30 hours per week.

A   Create a table to show each pay scale. Begin the table at 20 hours of work for each pay
scale and include entries for each additional five hours of work. Then indicate the pay
scale, (1) or (2), from which Manny can make the most money.

$5	$4	$7
30	>30

(2)

B   Will Manny make the most money from the answer you indicated in Part A all the time?
If not, how long must he work before one pay scale is better than the other? Justify your
answer.

$5 \times 300 = 1500$ $5 \times 600 = 30$

$5 \times 200 = 1000$ 5×500

$5 \times 90 = 450$ $5 \times 450 = 2250$

$5 \times 30 = \$150$

$4 \times 30 = 120$ 450 hours

$7 \times 30 = 2100$

Score Point: 0

Although the student indicates a pay scale, an incorrect table and no work are shown for Part A.
Some work is shown for Part B, but the student does not give an answer.

Michigan Educational Assessment Program
Statewide Test Item Analysis
HST in Mathematics
Grade 11 1st-Time Testers
Spring 2001

District: PUBLIC SCHOOL
Run Date: 08/09/2001

Multiple Choice

Item No.	Objective Code	Percent Answering by Response				
		A	B	C	D	Omit/Mult
Number						
04	NU	17	29	50*	3	1
23	NU	13	18	19	49*	1
Geometry and Measurement						
03	GE	49*	24	21	6	0冰
08	GE	26*	29	36	8	0冰
17	GE	2	38	55*	4	0冰
Data Analysis and Probability						
20	DA	50*	39	6	4	0冰
Algebraic Ideas						
06	AL	50	3	45*	2	0冰
19	AL	11	60*	23	6	0冰

Number Tested: 82180

Constructed Response

Item No.	Obj Code	Percent Receiving Number of Points											Percent Receiving Condition Codes			
		0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	A	B	C	D
Cross-Content																
33	CC	24	2	3	2	3	4	52					2	0	0	9
35	CC	31	6	15	4	3	3	32					1	0	0	6
36	CC	50	4	17	2	13							2	0	0	11
37	CC	23	5	7	3	4	5	16	4	21			2	0	0	11

Condition Codes for the Constructed Response Items:

A   Off-topic
B   Illegible
C   Written in language other than English
D   Blank/refused to respond

The Objective Codes correspond to those used in the *Assessment Framework for the Michigan High School Proficiency Test in Mathematics* (1994).

NU = Number
GE = Geometry and Measurement
DA = Data Analysis and Probability
AL = Algebraic Ideas
CC = Cross-Content

Number:
understanding and using whole numbers, integers, fractions, decimals, ratios, and percents to solve real world mathematical problems

Geometry and Measurement:
measuring, building, drawing, visualizing, and using informal methods to solve geometric problems; drawing valid conclusions from information; using properties of shapes and relationships among shapes to solve geometric and measurement problems geometrically

Data Analysis and Probability:
describing, interpreting, and analyzing data; solving problems using charts, tables, and graphs; describing, interpreting, and analyzing simple statistical and probability experiments

Algebraic Ideas:
representing and solving problems physically, graphically, verbally, and symbolically using models, variables, expressions, number sentences, and simple arrays; analyze and describe mathematical functions and relations

Cross-Content:
These items assess student mathematical reasoning across the four content strands described above. The cross-content score is based on the student's ability to communicate, reason, and present mathematical solutions to problems.

Omit/Mult = Omits and Multiple Responses
冰 Number of students present rounds to zero